OREGON COASTAL NONPOINT PROGRAM
NOAA/EPA PROPOSED FINDING
Draft 9/23/14

C. ADDITIONAL MANAGEMENT MEASURES - FORESTRY

PURPOSE OF MANAGEMENT MEASURE: The purpose of this management measures is to identify additional management measures necessary to achieve and maintain applicable water quality standards and protect designated uses for land uses where the 6217(g) management measures are already being implemented under existing nonpoint source programs but water quality is still impaired due to identified nonpoint sources.

CONDITION FROM JANUARY 1998 FINDINGS: Within two years, Oregon will identify and begin applying additional management measures where water quality impairments and degradation of beneficial uses attributable to forestry exist despite implementation of the 6217(g) measures.

PROPOSED FINDING:
(This finding is for all the additional management measures for forestry, not just pesticides. I'm leaving this blank.)

RATIONALE:
The federal agencies' January 13, 1998, conditional approval findings noted that Oregon had published forest practices rules that require buffer zones for most pesticide applications (OAR 629-620-0400(7)(b)). However, these rule changes did not address aerial application of herbicides along non-fish bearing streams. NOAA and EPA identified the adequacy of stream buffers for the application of certain chemicals as one of the existing practices under the FPA and FPR should be strengthened to attain water quality standards and fully support beneficial uses.

Since its 1998 conditional approval findings, Oregon has provided several documents describing the programs it relies on to manage pesticides, most recently in March 2014. In addition to the FPA rule buffers noted above, the state also addresses pesticide issues through the Chemical and Other Petroleum Product Rules (OAR 629-620-0000 through 800), Pesticide Control Law (ORS 634), best management practices set by the ODA, and federal pesticide label requirements under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), as well as the state's Water Quality Pesticide Management Plan and Pesticide Stewardship Partnership. In its March 2014 submittal, Oregon noted that it specifically relies on best management practices set by ODA and EPA under FIFRA for the protection of small non-fish bearing streams. Given the scientific evidence that points to potential adverse water quality and designated use impacts from the aerial application of herbicides, NOAA and EPA continue to believe that Oregon should take additional steps to ensure non-fish bearing streams are adequately protected during the aerial application of herbicides.

Aerial application of herbicides, such as glyphosate, 2,4-D, atrazine, and others, is a common practice in the forestry industry. Herbicides are sprayed to control weeds on recently harvested parcels to prevent competition with newly planted tree saplings. Within the coastal nonpoint management area, non-fish bearing streams comprise 60 to 70 percent of the total stream length. Oregon does not require riparian buffers during forest harvests along non-fish bearing streams; trees can be harvested up to the stream banks. Herbicides applied aerially over non-fish bearing streams are delivered directly into these streams which may then enter fish-bearing streams or drinking water supplies. Furthermore, there are no riparian buffers to filter herbicide-laden runoff before it enters the streams.

Research has shown that the aerial application of herbicides may adversely impact water quality and salmon. As discussed in EPA's *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters,* Norris and Moore (1971) found that the most adverse effects from the application of pesticides (including herbicides) occur when they are applied directly to water.[1] Direct application can occur by spraying pesticides directly over streams and through aerial drift. Norris and Moore also observed the concentration of 2,4-D in streams was one to two orders of magnitude higher in forestry operations without buffers than in areas with buffers. EPA's 1993 guidance also cites a study by Botkin (1994) that states in western Oregon and northern California, pesticides and fertilizers are applied at frequencies that indicate a potential for concern, and that fish are sensitive to some artificial chemicals.

In the NOAA National Marine Fisheries Services' (NMFS) biological opinion (BiOp) for several EPA herbicide labels, including 2,4-D, aerial drift was identified as the most likely pathway for these herbicides to enter aquatic habitats.[2] NMFS also noted that runoff was also a likely pathway for 2,4-D. The BiOp states that herbicides can have both direct and indirect effects on water quality and aquatic species, including salmon. One of the common indirect effects occurs because herbicides can reduce the growth and biomass of primary producers (algae and phytoplankton) that form the base of the aquatic food chain. The BiOp notes that a decrease in primary production can have significant effects on consumers that depend on the primary producers for food. These effects are often reported at herbicide concentrations well below concentrations that would have a direct effect on consumers. The BiOp discusses it is difficult to predict the magnitude and duration these impacts would have on juvenile salmon because the extent of salmonid effects often depend on the interaction with many different parameters, such as availability of alternative food sources, water temperature, and other abiotic factors.

There have been few peer-reviewed studies that have specifically evaluated the extent and effects of aerial application of herbicides on non-fish bearing streams within Oregon's coastal nonpoint management area. The non-peer reviewed studies that are available, such as ODF's analysis of

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[1] EPA. 1993. *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters*. U.S. Environmental Protection Agency, Office of Water, Washington, DC. EPA 840-B-92-002 January 1993.

[2] NMFS. 2011. *National Marine Fisheries Service Endangered Species Act Section 7 Consultation Biological Opinion Environmental Protection Agency Registration of Pesticides 2,4-D, Triclopyr BEE, Diuron, Linuron, Captan, and Chlorothalonil.* NOAA National Marine Fisheries Service, June 30, 2011.

aerial pesticide application on Type F (fish bearing) and Type D (drinking water) and monitoring results from the Alsea paired watershed study focused largely on impacts to fish-bearing streams so they cannot be used to draw conclusions about non-fish streams. With a lack of information about the specific impacts of herbicide spraying over non-fish bearing streams in Oregon and the wealth of scientific literature that shows a potential for negative effects, Oregon needs to ensure that it is providing adequate protections for non-fish bearing streams during the aerial application of herbicides.

The ODF monitored herbicides and fungicides along Type F (fish-bearing) and Type D (drinking water) streams to assess the effectiveness of the FPA pesticide management practices at protecting water quality during drift application.[3] Of 26 sites sampled 24 hours after application, all herbicides detected were at concentrations of less than 1 ppb, below the minimum exposure thresholds for humans and aquatic life. They concluded that the FPA's practices were effective at protecting water quality for Types F and D streams. However, they note they could not draw any conclusions about the FPA's effectiveness at protecting water quality for non-fish bearing streams during the aerial application of herbicides.

Similarly, the Alsea paired watershed study also found that while some herbicides were detected, they were not at levels that would pose a significant risk to humans or aquatic life.[4] Following the aerial application of herbicides over a non-fish bearing stream segment that did not have riparian buffers, the researchers measured herbicide concentrations at three locations below the application site: at the fish/non-fish bearing stream interface in the middle of the harvest unit; at the bottom of the harvest unit; and well below the harvest unit. Of the five herbicides that were applied, only glyphosate was detected in any of the samples. An initial pulse of glyphosate, ranging from about 40 to 60 ng/L (ppt), was recorded at the fish/no-fish interface site shortly after spraying but matched concentrations observed at the other two sites (approximately 25 ng/L) after three days. A clear pulse of approximately 115 ng/L (ppt) was recorded at the bottom of the harvest unit during a storm event that occurred eight days after application and another clear pulse of approximately 42 ng/L (ppt) was observed at the interface site during a second storm event ten days after spraying. All glyphosate concentrations recorded throughout the study period were orders of magnitude less than what the literature reported as the lowest observable effect for a variety of aquatic species. However, like the earlier ODF assessment, no samples were taken from a non-fish bearing stream segment that was directly under the application site. The water quality impacts to the non-fish bearing stream segment is unknown although one would expect to find higher concentrations of herbicides.

[3] Dent L. and J. Robben. 2000. *Oregon Department of Forestry: Aerial Pesticide Application Monitoring Final Report*. Oregon Department of Forestry, Pesticides Monitoring Program. Technical Report 7. March 2000.
[4] NCAIS (2013) [full citation but I haven't been able to access this report]

In 2010 and 2011, NMFS completed biological opinions and risk assessments for five herbicides that EPA and NMFS initially determined may adversely affect endangered and threatened salmon in Oregon. Of the five herbicides, only 2,4-D's use was determined by NMFS to jeopardizes salmon, and NMFS stated that the jeopardy determination was based heavily on 2,4-D's use for aquatic weed control. NMFS concluded that streamside buffers along salmon supporting streams were not necessary for all herbicides that were evaluated. There are currently three herbicides for which NMFS has yet to complete the biological opinions, and they have court-ordered buffers in place. The court ordered buffers are not part of FIFRA labels. Oregon asserts it is relies on the national best management practices established through the federal FIFRA pesticide labels to protect non-fish bearing streams. As the result of the different ways that federal agencies evaluated the impacts of pesticides on ESA-listed species, EPA, the National Marine Fisheries Service, the U.S. Fish and Wildlife Service, and the U.S. Department of Agriculture are currently working to improve the national risk assessment process to include all listed species when registering, all pesticides, including herbicides. **Ex. 5 - Deliberative**

Ex. 5 - Deliberative

Ex. 5 - Deliberative This ongoing federal process, however, should not preclude Oregon from making needed state-level improvements to how it manages herbicides in the context of its forestry landscape and sensitive species.

Other Pacific Northwest states have recognized the need to go beyond the national FIFRA label requirements to protect water quality and aquatic species, including salmon, in their state. Compared to neighboring coastal states and jurisdictions, Oregon has the smallest forestry-specific water resource buffers for herbicides. For smaller non-fish bearing streams, Washington maintains a 50-foot buffer (WAC-222-38-040). Idaho has riparian and spray buffers for non-fish bearing streams of 100 feet (IAR 20-02-01). California has riparian buffers for non-fish bearing streams (**), which implicitly restrict the aerial application of herbicides near the stream. To reduce aerial drift, Oregon has guidance that instructs applicators to consider temperature, relative humidity, wind speed, and wind direction; however, Washington, California, and the Bureau of Land Management add prescriptive technology and weather-related best management practices to address drift control.[5]

In addition to its reliance on federal label requirements, Oregon has taken independent steps to further address pesticide water quality issues. In 2007, key state agencies, including ODA, ODF, ODEQ, and the Oregon Health Authority, worked together to develop an interagency Water Quality Pesticide Management Plan to guide State-wide and watershed-level actions to protect surface and groundwater from potential impacts of pesticides, including herbicides. The plan,

[5] Peterson, E. 2011. ****[include full citation]

approved by EPA Region 10 in 2011, focuses on using water quality monitoring data as the driver for adaptive management actions. The plan describes a continuum of management responses, ranging from voluntary to regulatory actions the state could take to address pesticide issues. If water quality concerns cannot be addressed through the collaborative, interagency-effort, regulatory actions are taken using existing agency authorities.

As outlined in the plan, the State's Pesticide Stewardship Partnership (PSP) Program is the primary mechanism for addressing pesticide water quality issues at the watershed level. Through the partnership, the ODEQ works with State and local partners to collect and analyze water samples and use the data to focus technical assistance and best management practices on streams and pesticides that pose a potential aquatic life or human health impact.

NOAA and EPA acknowledge the progress Oregon has made in its establishment of a multi-agency management team, development of its Water Quality Pesticide Management Plan, and implementation of its PSP Program. However, the federal agencies note that water quality monitoring data on pesticides is still limited in the State, and that Oregon has only established eight PSP monitoring areas in seven watersheds, none of which are within the coastal nonpoint management area. While NOAA and EPA recognize that the PSP program targets the most problematic or potentially problematic watersheds and Oregon received recent funding to expand into two new watersheds, the agencies believe that if monitoring data are to drive adaptive management, the State should develop and maintain more robust and targeted studies of the effectiveness of its pesticide monitoring and best management practices within the coastal nonpoint management area. Moreover, the federal agencies encourage the State to design its monitoring program in consultation with EPA and NMFS so that it generates data that are also useful for EPA pesticide registration reviews and NMFS biological opinions that assess the impact of EPA label requirements on listed species.

In addition to a more robust, overall monitoring program for herbicides and other pesticides and to fully address the concerns NOAA and EPA raised in the 1998 conditional approval findings, Oregon may be able to achieve greater protection of non-fish bearing streams during the aerial application of herbicides through regulatory or voluntary approaches. An example of a regulatory approach would be to institute spray buffers for the aerial application of herbicides along non-fish bearing streams similar to neighboring states. Another option would be to institute riparian buffers along non-fish bearing streams, which, by default, would also provide a buffer during the aerial application.

Oregon could also institute voluntary programs, backed by enforceable authorities. These voluntary efforts could build on existing programs Elements of the voluntary program could include:

- Develop more specific guidelines for voluntary buffers or buffer protections for the aerial application of herbicides on non-fish bearing streams.

- Educate and train aerial applicators of herbicides on the new guidance and how to minimize aerial drift to waterways, including non-fish bearing streams, and surrounding communities;
- Revise the ODF notification form to include a check box for aerial applicators to indicate they must adhere to FIFRA labels for all stream types, including non-fish bearing streams;
- Track the implementation of voluntary measures for the aerial application of herbicides along non-fish bearing streams and assess the effectiveness of these practices to protect water quality and designated uses;
- **Ex. 5 - Deliberative**
- Provide better maps of non-fish bearing streams and other sensitive sites and structures to increase awareness of these sensitive areas that need protection among the aerial applicator community; and
- Employ GPS technology, linked to maps of non-fish bearing streams to automatically shut off nozzles before crossing non-fish bearing streams.

If Oregon chooses a voluntary approach, the state would also need to meet the other CZARA requirements for using a voluntary, incentive-based programs as part of the state's coastal nonpoint program. This includes describing the process the state will use to monitor and track implementation of the voluntary practices, providing a legal opinion stating it has the necessary back-up authority to require implementation of the voluntary measures, and demonstrating a commitment to use that back-up authority.

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Comment [AC1]: Added this lang. from decision doc per Christine's comment that we should make sure to reiterate what the condition/lang. regarding the issue form the 1998 decision doc was up front.

Comment [AC2]: Moved this up per latest direction from mngrs to discuss what the state is doing first.

Comment [CG3]: awkward

Comment [CG4]: I'm not sure why the word voluntary is here. EPA required that the State develop a Water Quality Pesticide Management Plan as a term of our cooperative agreement.

Comment [LL5]: Not sure what BMPs set by EPA means. Do you mean label directions?

Comment [LL6]: I don't think we have the scientific evidence. I would suggest deleting the first part of this sentence.

Ex. 5 - Deliberative

Aerial application of herbicides, such as glyphosate, 2,4-D, atrazine, and others, is a common practice in the forestry industry. Herbicides are sprayed to control weeds on recently harvested parcels to prevent competition with newly planted tree saplings. ~~In~~Within the coastal nonpoint management area, non-fish bearing streams comprise 60 to~~-~~ 70~~%~~ percent of the total stream length. ~~In addition,~~ Oregon does not require riparian buffers ~~for~~ during forest harvests ~~on~~ along non-fish bearing streams;~~. Therefore,~~ trees can be harvested up to the stream banks ~~along non-fish bearing streams~~. Herbicides applied aerially over non-fish bearing streams are ~~can be~~ delivered directly into these streams which may then enter fish-bearing streams or drinking water supplies. Furthermore, there are no riparian buffers to filter herbicide-laden runoff before it enters the streams.

Research has shown that the aerial application of herbicides may adversely impact water quality and salmon. As discussed in EPA's *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters,* Norris and Moore (1971) found that the most adverse effects from the application of pesticides (including herbicides) occur when they are applied directly to water.[1] Direct application can occur by spraying pesticides directly over streams and through aerial drift. ~~,~~ Norris and Moore ~~(1971)~~ also observed the concentration of ~~noted application of~~ 2,4-D in streams was one to two orders of magnitude higher in forestry operations without buffers than in areas with buffers. EPA's 1993 guidance also cites a study by Botkin (1994) that states ~~Botkin noted that~~ in western Oregon and northern California, pesticides and fertilizers are applied at frequencies that indicate a potential for concern, and that fish are sensitive to some artificial chemicals ~~(Botkin, 1994)~~.

In the NOAA National Marine Fisheries Services' (NMFS) biological opinion (BiOp) for several EPA herbicide labels, including 2,4-D, aerial drift was identified as the most likely pathway for these herbicides to enter aquatic habitats.[2] NMFS also noted that runoff was also a likely pathway for 2,4-D. The BiOp states that herbicides can have both direct and indirect effects on water quality and aquatic species, including salmon. One of the common indirect effects occurs because herbicides can reduce the growth and biomass of primary producers (algae and phytoplankton) that form the base of the aquatic food chain. The BiOp notes that a decrease in primary production can have significant effects on consumers that depend on the primary producers for food. These effects are often reported at herbicide concentrations well below concentrations that would have a direct effect on consumers. The BiOp discusses it is difficult to predict the magnitude and duration these impacts would have on juvenile salmon because the extent of salmonid effects often depend on the interaction with many different parameters, such as availability of alternative food sources, water temperature, and other abiotic factors. ~~The BiOp concluded that the use of 2,4-D in the Pacific Northwest jeopardizes salmon.~~

Comment [AC8]: We still lack studies that make this connection. It would be great to have something to close this loop. From my research, some herbicides can either bind up with sediment pretty quickly and/or have fairly short half lives in water. If that's the case, are they available to impair water quality/fish if they even make it to fish bearing streams?

NWEA brings up amphibian impacts. They can be more sensitive than salmon and perhaps are found in non-fish streams? Could that also be a designated use angle we could highlight if we have data to support?

Comment [LL9]: I agree with Allison's points here, unless you meant herbicides used for aquatic weed and algae control are applied directly into streams? I would suggest deleting this sentence since the following two paragraphs discuss effects of herbicides. If not, then perhaps delete the mentioning of drinking water because ODF may extend the length of Type D stream when protection of Type N stream is insufficient (see Page 5 of 14 in http://www.oregon.gov/odf/privateforests/docs/waterclassificationfptechnote1.pdf)

Comment [AC10]: Conc. may be higher but was it at levels known to cause impairments? We should find that out.

Comment [AC11]: This is a very broad statement that extends much further than herbicides are what we're dealing with here. Not sure how helpful such a broad statement is, especially since the herbcides are among the least toxic. The study is also 20 yrs old so one could argue that Oregon's pesticide use rates, types of chemicals applied, and mngt practices have changed since 1994 so this statement is not reflective of current practice. More current info on herbicide use specifically would be stronger and help ward against potential arguments like this.

Comment [AC12]: I only looked at BiOp that included 2,4-D. Would be good to skim the others for herbicides and make sure the same conclusions are made or acknowledge differences.

Comment [LL13]: I would suggest moving this sentence to the bottom of page 4 since the jeopardy conclusion should be elaborated more.

[1] EPA. 1993. *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters.* U.S. Environmental Protection Agency, Office of Water, Washington, DC. EPA 840-B-92-002 January 1993.

[2] NMFS. 2011. *National Marine Fisheries Service Endangered Species Act Section 7 Consultation Biological Opinion Environmental Protection Agency Registration of Pesticides 2,4-D, Triclopyr BEE, Diuron, Linuron, Captan, and Chlorothalonil.* NOAA National Marine Fisheries Service. June 30, 2011.

There have been few peer-reviewed studies that have specifically evaluated the extent and effects of aerial application of herbicides on non-fish bearing streams within Oregon's coastal nonpoint management area. The non-peer reviewed studies that are available, such as ODF's analysis of aerial pesticide application on Type F (fish bearing) and Type D (drinking water) and monitoring results from the Alsea paired watershed study focused largely on impacts to fish-bearing streams so they cannot be used to draw conclusions about non-fish streams. With a lack of information about the specific impacts of herbicide spraying over non-fish bearing streams in Oregon and the wealth of scientific literature that shows a potential for negative effects, Oregon needs to ensure that it is providing adequate protections for non-fish bearing streams during the aerial application of ~~herbicides~~herbicides.

The ODF monitored herbicides and fungicides along Type F (fish-bearing) and Type D (drinking water) streams to assess the effectiveness of the FPA pesticide management practices at protecting water quality during drift application.[3] Of 26 sites sampled 24 hours after application, all herbicides detected were at concentrations of less than 1 ppb, below the minimum exposure thresholds for humans and aquatic life. They concluded that the FPA's practices were effective at protecting water quality for Types F and D streams. However, they note they could not draw any conclusions about the FPA's effectiveness at protecting water quality for non-fish bearing streams during the aerial application of herbicides.

Similarly, the Alsea paired watershed study also found that while some herbicides were detected, they were not at levels that would pose a significant risk to humans or aquatic life.[4] Following the aerial application of herbicides over a non-fish bearing stream segment that did not have riparian buffers, the researchers measured herbicide concentrations at three locations below the application site: at the fish/non-fish bearing stream interface in the middle of the harvest unit; at the bottom of the harvest unit; and well below the harvest unit. Of the five herbicides that were applied, only glyphosate was detected in any of the samples. An initial pulse of glyphosate, ranging from about 40 to 60 ng/L (ppt), was recorded at the fish/no-fish interface site shortly after spraying but matched concentrations observed at the other two sites (approximately 25 ng/L) after three days. A clear pulse of approximately 115 ng/L (ppt) was recorded at the bottom of the harvest unit during a storm event that occurred eight days after application and another clear pulse of approximately 42 ng/L (ppt) was observed at the interface site during a second storm event ten days after spraying. All glyphosate concentrations recorded throughout the study period were orders of magnitude less than what the literature reported as the lowest observable effect for a variety of aquatic species. However, like the earlier ODF assessment, no samples were taken from a non-fish bearing stream segment that was directly under the application site. The water quality impacts to the non-fish bearing stream segment is unknown although one would expect to find higher concentrations of herbicides.

Comment [AC14]: Since the state discusses them in their submittal, we need to acknowledge the ODF and Alsea studies too and explain why we think these have shortcomings for understanding herbicide impacts on Type N. I added the next two para. to address.

Comment [AC15]: State submission and several commenters also discussed USGS study for Eugene Drinking water District. We should acknowledge that as well.

Comment [LL16]: I would suggest "associated with" the aerial applications of herbicides. "During" to me means when the application actually is taking place.

Comment [AC17]: Would be good to figure out how far below this was.

Comment [AC18]: The only summaries of this research I've been able to locate are in the state's March submittal and in a slide presentation/abstract at http://watershedsresearch.org/results/#alsea. The work has been published by NCASI 2013 but I haven't been able to access the actual report yet. Would like to read through full study to confirm these statements are accurate and provide more specificity to what "well below" means.

Comment [AC19]: I think this statement may be true but difficult to tell from the summary info I've been able to find so far. Can someone comfirm?

[3] Dent L. and J. Robben. 2000. *Oregon Department of Forestry: Aerial Pesticide Application Monitoring Final Report.* Oregon Department of Forestry, Pesticides Monitoring Program. Technical Report 7. March 2000.
[4] NCAIS (2013) [full citation but I haven't been able to access this report]

EPA's January 1993 CZARA guidance describes its 6217(g) management measures for forestry (EPA-840-B-92-002, 1993) which includes the need to control forest chemicals. The guidance notes that herbicides, insecticides, and fungicides (collectively termed pesticides) applied directly or aerially are most easily transported to surface water and groundwater (Norris and Moore, 1971), and that pesticides with high solubilities can be extremely harmful to aquatic organisms (Brown, 1974). As a result, the guidance calls for a forest chemical management management measure where the State will

> *"Use chemicals when necessary for forest management in accordance with the following to reduce nonpoint source pollution impacts due to the movement of forest chemicals off-site during and after application: (4) Establish and identify buffer areas for surface waters. (This is especially important for aerial applications.)"*

Comment [AC20]: I did not find this statement. Did I miss something? Guidance cites Norris/Moore (1971) "most adverse water quality effects related to the application of pesticides and fertilizers result from direct application of chemicals to surface waters of from chemical spills". Does not talk about aerial application.

Ex. 5 - Deliberative

The guidance states that the delivery of pesticides to surface waters from forestry varies depending on the type of application, presence or absence of buffers, and pesticide characteristics. Norris and Moore (1971) noted application of 2,4-D was one to two orders of magnitude higher in forestry operations without buffers than in areas with buffers. Fredriksen and others noted that in eight years of monitoring northwest forest streams, no herbicide residues were detected in water column one month after application. However, aquatic organisms and sediments were not sampled. Herbicide-induced changes in vegetation density and composition may cause indirect effects on streams such as increases in temperature or nutrients after riparian vegetation is eliminated. Fredriksen noted that unsprayed buffer strips should minimize these effects (Fredriksen et al., 1973). The guidance cites other studies that describe the benefits of buffers for aerial application of pesticides (Norris et al, 1991; Norris 1967). Botkin noted that in western Oregon and northern California, pesticides and fertilizers are applied at frequencies that indicate a potential for concern, and that fish are sensitive to some artificial chemicals (Botkin, 1994). Lastly, NMFS' biological opinion on 2,4-D and other herbicides note studies that describe potential harmful effects from herbicides on salmon health and habitat (NMFS, 2011).

Since its 1998 conditional approval findings, Oregon has provided several documents describing the programs it relies on to manage pesticides, most recently in March 2014. In addition to the EPA rule buffers noted above, the state also addresses pesticide issues through the Chemical and Other Petroleum Product Rules (OAR 629-620-0000 through 800), Pesticide Control Law (ORS 634), best management practices set by the ODA, and federal pesticide label requirements under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), as well as its voluntary Water Quality Pesticide Management Plan and the state's Pesticide Stewardship Partnership. In its March 2014 submittal, Oregon noted that it specifically relies on best management practices set by ODA and EPA under FIFRA for the protection of small non-fish bearing streams.

In 2010 and 2011, NMFS completed biological opinions and risk assessments for five herbicides that EPA and NMFS initially determined may adversely affect endangered and threatened salmon in Oregon. Of the five herbicides, only 2,4-D's use was determined by NMFS to jeopardizes salmon, and NMFS stated that the jeopardy determination was based heavily on 2,4-D's use for aquatic weed control. NMFS concluded that streamside buffers along salmon supporting streams were not necessary for all herbicides that were evaluated. There are currently three herbicides for which NMFS has yet to complete the biological opinions, and they have court-ordered buffers in place. The court ordered buffers are not part of FIFRA labels. ~~NMFS completed biological opinions for herbicides in Washington and Oregon and assessed risks to ESA-listed Pacific salmon and steelhead. These biological opinions determined that streamside buffers were not necessary for the herbicides that were evaluated. There are currently three herbicides that have court-ordered buffers in place. The biological opinions and court-ordered buffers are not required to be and are not currently included in FIFRA labels.~~

Oregon asserts it is relies on the national best management practices established through the federal FIFRA pesticide labels to protect ~~of~~ non-fish bearing streams. As the result of the different ways that ~~several pesticide-related lawsuits regarding how~~ federal agencies evaluated the impacts of pesticides on ESA-listed species ~~and establish label requirements~~, EPA, the National Marine Fisheries Service, the U.S. Fish and Wildlife Service, and the U.S. Department of Agriculture are currently working to improve the national risk assessment process to include all listed species when registering, ~~product label requirements, and best management practices for~~ all pesticides, including herbicides. Ex. 5 - Deliberative

Ex. 5 - Deliberative This ongoing federal process, however, should not preclude Oregon from making needed state-level improvements to how it manages herbicides in the context of its forestry landscape and sensitive species. ~~requested the National Academies of Science to review existing methods for assessing pesticide risk to listed species and to recommend improvements to the risk assessment process. The federal agencies have agreed to work jointly to implement the study's recommendations, which were released April 30, 2013, in a phased, iterative approach over the next 15 years. As a result, the agencies are in the process of modifying the methods for risk assessment that may affect the future labeling requirements and best management practices for herbicide applications. (ESA, (BEST), (DELS), & Council, 2013)~~

~~There have been no peer-reviewed studies to date that evaluate the extent and effects of aerial application of herbicides on non-fish bearing streams in the coastal nonpoint management area.~~ Other Pacific Northwest states have recognized the need to go beyond the national FIFRA label requirements to protect water quality and aquatic species, including salmon, in their state. Compared to neighboring coastal states and jurisdictions, Oregon has the smallest forestry-specific water resource buffers for herbicides. For smaller non-fish bearing streams, Washington maintains a 50-foot buffer (WAC-222-38-040). Idaho has riparian and spray buffers for non-fish bearing streams of 100 feet (IAR 20-02-01). California has riparian buffers for non-fish bearing streams (**–), which implicitly restrict the aerial application of herbicides near the stream ~~limit the herbicide use since~~ applying herbicides ~~over the riparian buffer would destroy the~~

Comment [LL22]: I would suggest keeping this paragraph but add the years that NMFS issued the biological opinions. This will give readers an idea of what happened chronologically. Do we want to mention because of a court order, EPA assessed risks associated with herbicides use on endangered and threatened salmon in Oregon? Ex. 5 - Deliberative

Ex. 5 - Deliberative

Comment [AC23]: Since seems out of here. Not sure it's needed.

Comment [LL24]: The reason was not a lawsuit, It was disagreements between EPA and NMFS on the assumptions used for risk assessment modeling.

Comment [LL25]: The agencies are not working on labels or BMPs, just risk assessment.

Comment [AC26]: Riparian or spray?

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buffer.would eliminate vegetation. Bureau of Land Management (BLM) lands in Oregon require that "no herbicide treatments should occur within 100 feet of a well or 200 feet of a spring or known diversion used as a domestic water source unless a written waiver is granted by the user of owner" (http://www.blm.gov/or/plans/vegtreatmentseis/files/Veg_Treatments_ROD_Oct2010.pdf). To reduce aerial drift, For drift control, Oregon has guidance that instructs applicators for to considering temperature, relative humidity, wind speed, and wind direction for drift control; h. However, Washington, California, and the Bureau of Land ManagementLM add also have prescriptive technology and weather-related best management practices to address drift control.[5] (Peterson, 2011).

Comment [AC27]: This is all about drinking water so don't think its relevant here.

Comment [AC28]: I assume precipitation is also included or not?

Comment [AC29]: By "have" do we mean "requirements for" or just guidance as well?

Comment [AC30]: How are these different from OR's guidance to consider various weather conditions?

Comment [AC31]: Use footnote citation. - *JW noted*

In addition to its reliance on federal label requirements, Oregon has taken independent steps to further address pesticide water quality issues. In 2007, key state agencies, including ODA, ODF, ODEQ, and the Oregon Health Authority, worked together to develop an interagency Water Quality Pesticide Management Plan to guide State-wide and watershed-level actions to protect surface and groundwater from potential impacts of pesticides, including herbicides. The plan, approved by EPA Region 10 in 2011, focuses on using water quality monitoring data as the driver for adaptive management actions. The plan describes a continuum of management responses, ranging from voluntary to regulatory actions the state could take to address pesticide issues. If water quality concerns cannot be addressed through the collaborative, interagency-effort, regulatory actions are taken using existing agency authorities.

As outlined in the plan, the State's Pesticide Stewardship Partnership (PSP) Program is the primary mechanism for addressing pesticide water quality issues at the watershed level. Through the partnership, the ODEQ works with State and local partners to collect and analyze water samples and use the data to focus technical assistance and best management practices on streams and pesticides that pose a potential aquatic life or human health impact.

NOAA and EPA acknowledge the progress Oregon has made in its establishment of a multi-agency management team, development of its Water Quality Pesticide Management Plan, and implementation of its PSP Program. However, the federal agencies note that water quality monitoring data on pesticides is still limited in the State, and that Oregon has only established eight PSP monitoring areas in seven watersheds, none of which are within the coastal nonpoint management area. While NOAA and EPA recognize that the PSP program targets the most problematic or potentially problematic watersheds and Oregon received recent funding to expand is expanding into two new watersheds, the agencies believe that, if monitoring data are to drive adaptive management, the State should develop and maintain more robust and targeted studies of the effectiveness of its pesticide monitoring and best management practices within the coastal nonpoint management area. Moreover, theThe federal agencies encourage the State to design its monitoring program in consultation with EPA and NMFS so that it generates data that are also

Comment [LL32]: We should recognize that Oregon is not randomly selecting watersheds to monitor.

[5] Peterson, E. 2011. ****[include full citation]

useful for EPA pesticide registration reviews and NMFS biological opinions that assess the impact of EPA label requirements on listed species.

~~While the federal agencies are moving forward with a national solution with how risk assessments for pesticide label requirements are conducted, that does not preclude Oregon from taking action to establish buffers or buffer protections for aerial application of herbicides on Type N streams. Examples of ways the State could have an approvable program are through an enforceable or voluntary program with monitoring and tracking.~~

In addition to a more robust, overall monitoring program for herbicides and other pesticides and, to fully address the concerns NOAA and EPA raised in the 1998 conditional approval findings, Oregon may be able to achieve greater protection of non-fish bearing streams during the aerial application of herbicides through regulatory or voluntary approaches. An example of a regulatory approach ~~n enforceable program~~ would be to institute ~~statewide~~ spray buffers for the aerial application of herbicides ~~on Type N~~ along non-fish bearing streams similar to neighboring states. ~~-~~Another option would be to ~~Oregon could also~~ institute riparian buffers along non-fish bearing ~~on Type N~~ streams, which, by default, would also provide a buffer during the aerial application ~~for herbicides~~.

Oregon could also institute voluntary programs, backed by enforceable authorities. ~~An example of a voluntary program with monitoring and tracking would be for the State to develop guidance and policies on voluntary buffers or on buffer protections for aerial application of herbicides on Type N streams.~~ These voluntary efforts could build on existing programs ~~already in place with the addition of monitoring and tracking.~~ Elements of the voluntary program could include ~~the following~~:

- Develop more specific ~~G~~guidelines for voluntary buffers or buffer protections for the aerial application of herbicides on ~~Type N~~ non-fish bearing streams.
- ~~Outreach~~ Educate and train ~~by ODA~~ ~~to~~ aerial applicators of herbicides on the new guidance and how to ~~that focuses on~~ minimize~~ing~~ aerial drift to waterways, including ~~on Type N~~ (non-fish bearing) streams, and surrounding communities~~, including voluntary buffers~~;
- Revise the ODF notification form to include a check box for ~~indicating that~~ aerial applicators to indicate they must adhere to FIFRA labels for all stream types, including ~~Type N~~ non-fish bearing streams;
- ~~Monitoring~~ Track the ~~effectiveness of~~ implementation of voluntary measures for the aerial application of herbicides~~buffers~~ along non-fish bearing streams and assess the effectiveness of these practices to protect water quality and designated uses~~;~~ ~~on non-fish bearing streams in the coastal nonpoint management area for the aerial application of herbicides;~~
- ????Conduct ~~D~~direct compliance monitoring ~~efforts by ODA of~~ for FIFRA label requirements related to ~~s for~~ aerial application of herbicides in forestry;???

Ex. 5 - Deliberative

Comment [AC34]: OR already has guidelines to minimize drift (see above para.) I think a few specific examples are needed here for the state to understand what additional specificity we're looking for.

Comment [AC35]: Do we really care WHO does it as long as it's done? Extension agents could be a good vector?

Comment [CG36]: Be specific with the name of the notification form.

Comment [LL37]: How can compliance monitoring be a voluntary program? This bullet is needs a bit more clarification.

- Provide better ~~Better~~ map~~sping~~ of ~~Type N~~ non-fish bearing streams and other sensitive sites and structures to increase awareness of these sensitive areas that need protection among the aerial applicator community; and
- Employ GPS technology, linked to maps of non-fish bearing streams to ~~Better use of maps and GPS to~~ automatically shut off nozzles ~~when crossing Type N~~ before crossing non-fish bearing streams.

Comment [AC38]: This isn't something the state can do. This is a BMP it would recommend applicator adopt. Therefore, should it be an example under the first bullet rather than listed here?

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If Oregon chooses a voluntary approach, the state would also need to meet the other CZARA requirements for using a voluntary, incentive-based programs as part of the state's coastal nonpoint program. This includes describing the process the state will use to monitor and track implementation of the voluntary practices, providing a legal opinion stating it has the necessary back-up authority to require implementation of the voluntary measures, and demonstrating a commitment to use that back-up authority.

~~REFERENCES:~~

~~National Marine Fisheries Service, Endangered Species Act Section 7 Consultation, Biological Opinion. Environmental Protection Agency Registration of Pesticides. 2.4-D, Triclopyr BEE, Diuron, Linuron, Captan, and Chlorothalonil.~~